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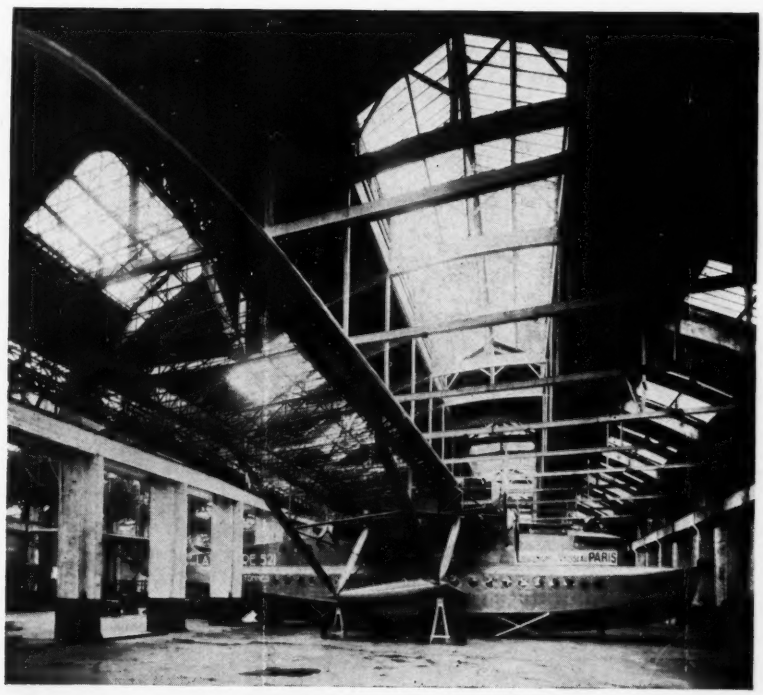
The CORNELL ENGINEER



In This Issue:

EUROPE BY AIR *By W. H. Johns, A.E., '39*

Volume 2 JANUARY, 1937 Number 4

(Teeth Not Tension)

Boosts Production Efficiency of America's Machine Tools

On gear shapers and turret lathes, milling machines, grinders and drill presses —on nearly every type of machine-tool in American industry—Morse Chain Drives are helping boost production, cut down power costs, and stamp out costly transmission breakdowns.

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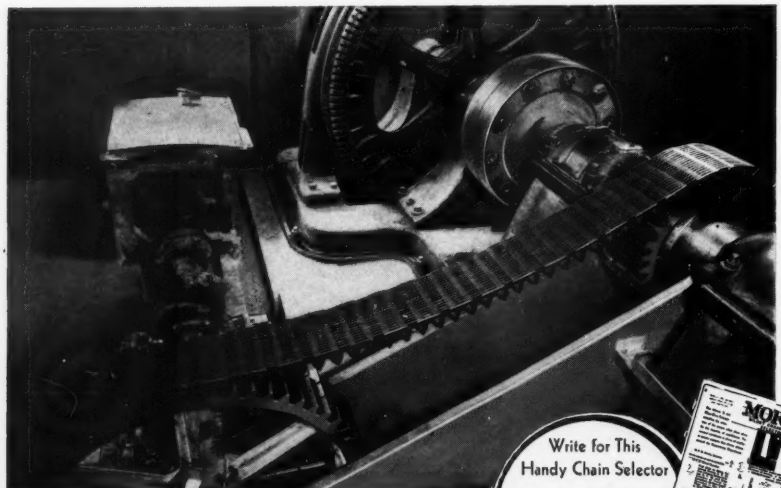

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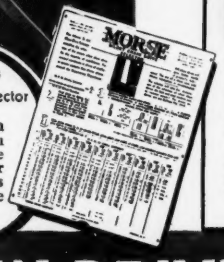

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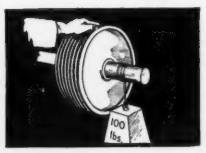
It is difficult to get a good grip on a smooth-faced wheel.



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THE CORNELL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR

Volume 2 | JANUARY, 1937 | Number 4

COMMENTS

"To Europe by Air" written by a student, very fairly compares the advantages of dirigible with airplane trans-oceanic travel.

* * *

The article concerning safer and saner driving should be of interest to all readers both because of its current importance and practical suggestions. In addition, it is a copy of an original radio script, and shows how such programs are prepared for radio presentation.

* * *

The new Triborough bridge in New York City has several interesting features which are discussed in an article by David Benjamin, M.E. '38.

* * *

The center-spread shows the student the importance of careful letter writing. It is a reprint from the November issue of the *Michigan Technic.*

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Sage Chapel

The
CORNELL ENGINEER

Volume II | January, 1937 | No. 4

To Europe By Air

By W. H. Johns, A.E. '39

Upon reading this title, many of those who delighted in the activities of the early flying men immediately think of the first trans-Atlantic hops started off by that of Lindbergh. When we make our mental comparison of conditions surrounding that first non-stop flight from New York to Paris, with the condition that will prevail when the new trans-Atlantic Airplane service is inaugurated, we realize what rapid progress has been made in heavier-than-air aviation in these last nine years. Equipment is so much improved that flying Lindbergh's hazardous course will soon be a routine hop.

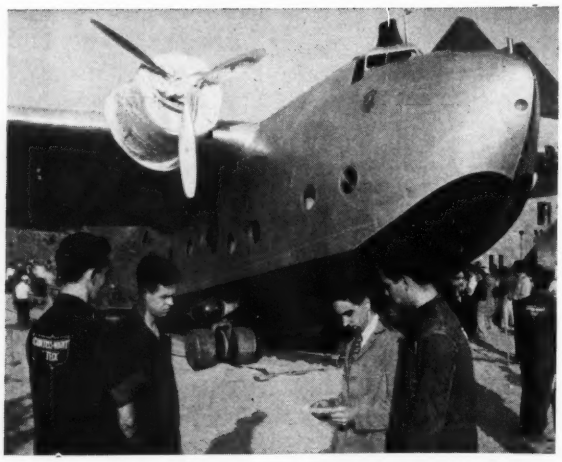
Already the *Hindenburg* runs an experimental service between New York and Frankfort, Germany, to test the feasibility of the airship on the North Atlantic service. She has attracted much attention to the future air-service between the Old and New World, and is giving us a standard with which to measure the value of the airship. When experimental airplane flights are completed in the near future by Pan-American Airways, we will have something to compare with the *Hindenburg's* record. From them we can determine the more useful and safer craft for the job. In the meantime we can use the data collected by Pan-American Airways in Ocean flying over the Pacific and apply it to problems arising in Atlantic service.

It is the author's opinion that we will find that neither the airplane nor the airship should be discarded in favor of the other; rather will it appear that each is suited for a particular job in the carrying of mail, cargo, and passengers across the North Atlantic by air.

The two important differences between the dirigible and flying boat lie in *useful load* and cruising speed. *Useful load* may be defined as that portion of the gross weight of a loaded aircraft which does not form part of the structure or power plants. This can be further divided into *payload,* and that portion of the *useful load* which is made up of fuel, oil, and furnishings for the comfort of passengers. *Payload* is of course the weight of the passengers, mail, or cargo being transported for profit. Since the *useful load* is composed of fuel, etc., and *payload*, it follows that a plane or dirigible with a large fuel load cannot carry much *payload*. The reverse is also true. The large and bulkier dirigibles can carry substantially more *payload* than the present flying boats or other practical heavier-than-air-craft of the near future. This favors its use for carrying express cargo, while its slower cruising speed makes it less desirable for express passenger service than the airplane. Man has always turned to the faster of two means of transportation for his own use, when each is equally safe.

When comparing the speed of the dirigible with that of the airplane it is best to calculate the elapsed time en route between the important termini. A fairer comparison results because some of the airplane's greater speed is sacrificed in flying a longer route. Since elapsed time is what interests the potential user of this express service, that should be used. On this basis, the dirigible's cruising speed compares more favorably with the airplane's than it would if standard cruising speeds were considered. The present "Clipper Ships" of the Pacific service cruise fully twice as fast as the "Hindenburg" over the measured mile at three-quarters engine speed, but their advantage is cut down considerably by stops for fuel and longer routes between New York and continental Europe. These fuel stops must be made with existing heavier-than-air equipment because of the far shorter cruising range of the airplane. In order to carry sufficient payload to make the flight feasible, while maintaining a margin of safety, there should not be any hop over 2,500 miles. Hence the southerly route by way of Bermuda and the Azores must be taken. There is another route which offers the stepping-stones which flying boats need—the Northern or Labrador route. However, weather conditions over this route make its use inadvisable with existing weather forcasting facilities. For the present, then, the airplane must sacrifice some of its high speed in order to fuel up often enough for safety. Still, it should prove substantially faster than the dirigible, and further advances will increase the airplane's safety margin.

When explaining the reason for the dirigibles greater



Douglas 32-Passenger Flying Boat for Ocean Service

cruising range, which is its greatest asset, I will use for comparison the "Hindenburg" and Martin "Clipper Ships", each the most modern example of the equipment in its particular field.

The "Hindenburg" has a gross weight of about 430,000 lbs., and a useful load of about 180,000 lbs. A Martin "Clipper's" gross weight is 52,000 lbs., and it has a useful load of 26,390 lbs. From these figures it is easy to see why the dirigible can carry much more fuel for its 4800 H.P. engines than the flying boat can for her 3300 H.P. engines. The former, about 8 times as heavy as the latter and carrying 7 times the useful load, has a little more powerful power plant to fuel. Hence she can travel 8750 miles with her normal payload, while the "Clipper" is limited to shorter hops of about 3,000 miles when carrying passengers.

As a result the airship travels in a direct great circle route from New York to Germany without fuel stops. She has a comfortable margin of safety in case of adverse conditions forcing her to stay aloft for many extra hours. This is probably the airships greatest safety feature; however, the "Clipper" does not need reserve fuel capacity to the extent the "Hindenburg" does. There is nothing to hinder the "Clipper's" progress to the extent that extremely high winds hold back an airship. The airplane's comparatively low drag in high winds enables her to buck headwinds and reach her destination without a great loss of time, while the airship is often slowed down to little or no headway against winds encountered at her flying levels. Furthermore, the dirigible is less manouverable in rough weather when trying to run from the path of sudden storms. This, and the fact that her schedules are often interrupted when a landing or takeoff must be made in high winds, constitute one of the greatest drawbacks of the airship, and they offset the advantage of such a large cruising range, when safety is being considered.

The airplane route via the Azores and Bermuda includes important travel centers with potential passenger fares. The airplane is best suited to serve these intermediate ports because it is easy to land and manouver on the ground. Even if the airship were so fast that she could afford to fly the longer Bermuda-Azores route in order to serve a greater market, the expense and trouble of housing and landing the dirigible would be too great. The cost of providing hangars for the "Hindenburg" at more than two or three ports would be prohibitive at present, for this reason she must ply between Lakehurst and Frankfort and omit other stops. All this points to the use of the airplane in the proposed passenger service.

With 180,000 lbs., useful load and an enormous interior space for storing cargo, the airship has a definite advantage in carrying air-express. It would be practical to assemble all express cargo from United States at one port and transport it by non-stop dirigible to one central spot in Europe, whence it could be distributed throughout the continent. This would make possible a two and one-half day saving over present super-liner speeds for East-bound traffic and about a two day saving in West-bound traffic. Mail could be apportioned between the airplane and the airship, with the airship getting the greater bulk. The airplane might take some mail when passenger lists were not well filled, to help defray operating expenses and to speed the mails even faster. Of course, agreements would have to be made through the Post Office Department in order to insure enough cargo to make the airship operation worth while.

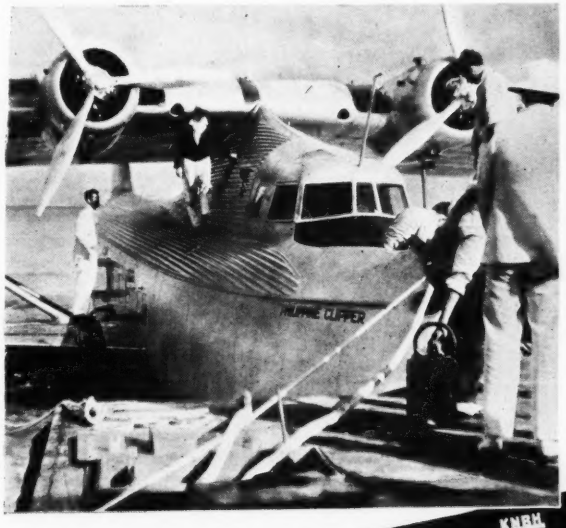
The question is raised, why doesn't it take a fleet of planes to carry the passengers a dirigible could handle since it carries seven times the useful load? The answer is that we do not reckon passengers in pounds but in numbers, and the dirigible is not suited for utilizing much of its available space for passengers, while the airplane uses most of it for passengers. The "Clipper" would carry about twenty-five passengers when ready for Atlantic service, while the "Hindenburg" carries but twice that number. Thus it appears that the airship is naturally endowed for its job of cargo carrying and the airplane is endowed for its job of passenger carrying.

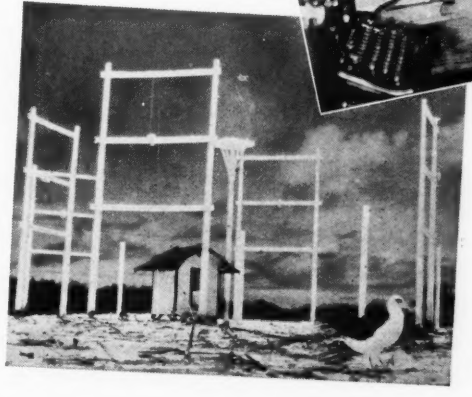
When discussing safety in connection with cruising ranges no definite conclusions can be drawn as yet. We can but enumerate the several safety-promoting factors inherent in each design. Too many variables are under constant experimentation at this time to allow guessing how safe the aircraft of tomorrow will be. We do expect that each craft will exhibit the same characteristic faults, however, these faults will be partially overcome. Before the public is allowed to use the Atlantic air-service, the hazards of the flight will be put under reasonable control. All conceivable breakdowns will be prepared for, and many experimental flights made to test the equipment under all conditions. As soon as these practice flights get under way, methods of coördinating the many new aids to aerial navigation will be devised. Already great demands for better ocean weather data to be sup-

plied while over the Atlantic, are the result of experiences gained by the "Hindenburg's" commanders. Demand usually stimulates supply in such experimental work; in this same way the other hazards will be met and overcome before regular service begins.

At present the airplane offers the following safety features.

In the present four-motored design of the "Clippers" the plane can continue through average weather conditions even if two of its motors fail. As each motor is a complete unit with its fuel and lubricating equipment, the failure of two motors can be classed as an unlikely event. Should more than two motors fail or should any other untoward event occur, the plane can alight on the water and survive all but hurricane seas for an extended period. Once landed, the motors, can be repaired and the flight resumed, or help from surface craft summoned by the modern two-way radio equipment carried on these planes. When all these features are considered along with the fact that there is little likelihood of even single engine failure, we realize what a cool, business-like science such flying has become, entirely lacking that uncertainty which made Lindebergh's thirty-two hour flight a daring adventure.





AVIATION

Above: Martin "Clipper" flying boat being serviced at a Pacific stop. Right and below: Radio is one of the greatest steps to insure safety.

The dirigible is handicapped by its bulkiness and great size. It is subjected to great strains along its length when buffeted by winds of high velocity. Too few flights have been made over the North Atlantic by the airship to prove that she is safe enough for regular passenger service. The twenty flights scheduled for the coming summer by the "Hindenburg" will add greatly to our knowledge of her stamina under operating conditions. Her important advantage over the airplane from the standpoint of safety, is her ability to remain aloft in case of engine failure.

It is easy to see that the question of relative safety of the two craft is still a moot one, with good arguments available to support either side. However, as mentioned above, the passenger on future trans-Atlantic flights in either craft can be sure of the latest apparatus to insure his safety that science can provide.

Among the concrete evidences of these plans for service in the near future, the following are listed: the establishment of two radio broadcasting transmitters on Long Island by Pan American the recent shipment of a large Imperial Airways flying boat of the "Canopus" type to Bermuda for use in the Bermuda-New York service; the trial flights by two German flying boats from the Azores to Long Island last summer, and news of the order for six tremendous flying boats of forty-three tons each from the Boeing Airplane Company. This latter ship will be substantially larger than the twenty-six ton Martin "Clipper" and the trend is towards even larger flying boats soon after.

All these preparations lend excitement to thought as one contemplates a Europe brought to within thirty hours of New York, and those connected with the aviation industry watch every step with keen interest. Other technical men are watching, trying to anticipate what changes will take place in the standard of living as a result of this progress. Mr. and Mrs. America are becoming interested, too, as the plans come nearer and nearer completion. So, in 1940, if you want to see London, Paris, Berlin and Vienna and only take a week off from work in New York, travel by air.

A Radio Address on SAFE DRIVING

EDITOR'S NOTE—*Following is the actual script, used in the radio presentation as outlined.*

Introduction to the discussion between Murray D. Van Wagoner, State Highway Commissioner, and Mr. R. C. Hargreaves, of Detroit, over Radio Station WXYZ Detroit, beginning at 10:00 P. M., Thursday, May 21, 1936.

"How the State Highway Department serves the people of Michigan" . . . A Discussion between our State Highway Commissioner, the Honorable Murray D. Van Wagoner, and Mr. Robert C. Hargreaves, of Detroit.

(THEME)

We bring you tonight the tenth of a series of addresses and discussions dealing with the affairs and accomplishments of the State Highway Department, a vital division of your State government.

Tonight Mr. Hargreaves will interview Commissioner Van Wagoner on the subject "Safety on the Highways." Safety is one of the gravest problems confronting our Nation today. Mr. Hargreaves is particularly fitted to carry on this discussion with our State Highway Commissioner. He served under President Wilson during the World War as secretary of the Highway Transport Committee of the Council of National Defense. Mr. Hargreaves is now associated with the investment banking firm of American Industries Corporation, Detroit. It is indeed a pleasure to introduce Mr. Hargreaves and Commissioner Van Wagoner . . .

Thank you, Mr. . . . :

Mr. Hargreaves—Good evening, Mr. Van Wagoner. I appreciate this opportunity to be with you, and hope we may be able to help end this mounting toll of death and destruction on our highways. I have come to think of this catastrophe as the warfare on the highway. More lives are being destroyed and maimed in it than in all the military wars of this nation. To what do you attribute this increasing death rate on our nation's highways? Where do the root causes lie, Mr. Commissioner?

Mr. Van Wagoner—In general, Mr. Hargreaves, I feel that the root causes lie in a lack of balance between the capacities of the vehicle, the roadway, and the operator.

Mr. Hargreaves—What, in your opinion, caused this unbalanced condition, Mr. Commissioner?

Mr. Van Wagoner—It is the result of the revolutionary development of the automobile. Go back with me to the horse and buggy days. There was none of this warfare on the highways then, just a few runaways. There was a balance between the capacity of the horse drawn vehicle, the roadway and the driver. Then came the automotive revolution—the application of a new and unused power to the vehicle. It stretched the measure of a day's journey from thirty to three hundreds miles and upward. The balance between the capacities of the vehicle, on the one hand, and the roadway and operator on the other, was destroyed. Warfare on the highway resulted.

Mr. Hargreaves—Is it not a fact, Mr. Van Wagoner, that the capacity of the most recently constructed highways in this state have been brought pretty well into balance with the capacity of the vehicle?

Mr. Van Wagoner—Yes, this is true. Our efforts have been directed to this end for many years. In fact, during my administration, we have materially revised and advanced the design of our highways and bridges. No new highway is being built without safety being incorporated in it up to the limit of engineering and scientific experience.

Mr. Hargreaves—What would you say about the so called super-highways?

Mr. Van Wagoner—We feel that our modern superhighways, like wider Woodward Avenue, for example, are well in balance with today's requirements. Just think of this great concrete highway; two eighty-foot lanes for traffic with a forty-foot parkway separating the flow. Compare it with the twelve-foot plank toll road over which the first automobiles traveled in 1903. Surely it is a revolutionary change in the roadway, and it fully maintains a balance with the revolutionary change in the vehicle.

Mr. Hargreaves—Is it true, Mr. Commissioner, that in addition to building safety into new trunkline highways, you are constantly at work building greater safety into our existing highway system?

Mr. Van Wagoner—Most certainly. As an instance of this, you will be interested in knowing that your state Highway Department has eliminated nearly four hundred dangerous curves and turns in the past two and a half years. These were on existing trunk line highways. Not only was visibility or "'sight distance" improved, but definite hazards were done away with.

Mr. Hargreaves—In spite of all that you are doing, is it not true that the State Highway Department is confronted with a gigantic problem in rebuilding hundreds of miles of highways that are no longer adequate for modern traffic demand?

Mr. Van Wagoner—Yes. I am very glad you

brought this up. We have a long way to go to bring the entire 9,000 miles of trunkline highways up to date. The surface is nearly worn out on many of our roads, and the curves are too sharp and the grades too steep for traffic that moves at present-day speeds. Our State-wide highway planning survey now in progress will reveal the exact location of these danger spots. It will show where improvements are most necessary and give some indication of the type of improvement that should be made.

Mr. Hargreaves—With your permission, Mr. Commissioner, may I leave the roadway and the question of its capacity, and talk with you a moment about the users of the highway and their capacity? By users, I mean operators of vehicles as well as pedestrians. I heard a man say recently that we have put more under the hood than we have put under the hat. I have also recently read the opinion that the increased speed of the motor car requires that men become more unselfish to operate them; but men have not become more unselfish, and the toll of the road measures the failure. How do you feel about this point, Mr. Van Wagoner?

Mr. Van Wagoner—You are aboslutely right. The State Highway Department recognizes the human problem, and we have started to do something about it. We have built and exhibited a reaction-time testing machine throughout the state. It is an educational device to impress upon motorists the need for extreme caution in handling an automobile. We have measured the time required by fifty thousand motorists to remove their foot from the accelerator and apply the brake. Studies gained from these tests show that few motorists know the facts that control safe driving.

Mr. Hargreaves—Mr. Commissioner, is it not true that the attitude and spirit of the average driver can mean far more to the cause of safety than his so-called reaction time?

Mr. Van Wagoner—Unquestionably this is true.

Mr. Hargreaves—Then is not the real need for today's leadership one of furthering a new spirit and attitude in the average motorist which will eliminate accidents?

Mr. Van Wagoner—Yes, I must say that despite all the physical improvements in our highways, coupled with the safest car that has ever been produced, the accident toll still appears on the increase. It is self-evident that we have not gone to the real root of the problem. Supposing I say I do agree with you? Will you permit me to ask you the next question? How and where would you start in to do this, and, as an average citizen and business man, what are you going to do about it?

Mr. Hargreaves—Thank you, Mr. Van Wagoner, I will gladly try. There is only one place to start. It is with oneself. For me, safe driving did not start on the highway at all. It had to start in my own home. Before I woke up to the source of my difficulty, accidents were getting all set to happen before I got onto the highway at all. In fact, they were often happening before I even got outside my own front door. I had to re-assess my relations with others. Finding them lacking I had to commence living in a constructive relationship with everyone I know.

Note please, Mr. Commissioner, this fact. I had to do something about it myself. The change had to come in my own attitude, first.

Simply as a by-product of this experience I found myself driving my car quite differently. The old "I" was no longer in the driver's seat. A changed attitude was the result. It allowed me to enter into the whole life of the highway before me, with consideration and understanding; releasing my mind for the concentration and consideration needed in the job of safe driving. This quality of driving simply reflects a new control and quality in the life of the driver that does eliminate accidents.

Mr. Van Wagoner—I believe I get your idea, Mr. Hargreaves. One's conduct on the highway, being a part of life, naturally reflects one's conduct in every other part of his life.

Mr. Hargreaves—Exactly. Out of my experiences to date, in learning to be guided by this new spirit, I will gladly share with you and this radio audience the following four steps which are helping me acquire this new control.

First step. Keeping my car in safe mechanical condition. In the past I had not been particular about the condition of the car I was driving; about the brakes, the stearing gear, headlights, tires, clear vision, etc. The first step in this new control is absolute honesty, and it requires that I see to this safe condition of my car.

Second Step. Entering into the whole life of the highway with consideration and understanding. Heretofore, war flared up in me as I tried to overtake and pass another car which was being driven down the center of the roadway. I forgot the many times I had driven this way myself. War also flared up in me when someone suddenly crowded my path, or when children playing at the roadside suddenly darted out onto the highway. Now, with absolute consideration as a part of my new control, I aim to have it include the whole life of the highway as it stretches out before me. I drive as though "that other car" contained my wife and as though the children playing at the roadside were my own.

Mr. Van Wagoner—Pardon my interruption, Mr. Hargreaves. I see very clearly that if we drove as though every other car contained members of our own family, there just would not be any accidents at all. This has to start with me and with you. Go on, please.

Mr. Hargreaves—*Third Step.* Keeping at once relaxed and concentrated on safe driving. In the past my

driving had been jerky and full of danger to others, especially as I became absorbed in talking with some one riding with me. Conflicts, past or present, which involved me, made me tense and competed with the driving for thought and attention. This third step in this new control requires that I give absolutely undivided thought and attention to the job of safe driving.

Fourth Step. Being always in the right place on the road surface at every moment. Selfishly, in the past I drove as an opportunist, jumping into this opening or that, irrespective of others. I find now that the fourth step in this new control, absolute unselfishness, causes me to be generally on the extreme right of the roadway, taking up as little of the road surface as possible. Especially I realize that where curves or grades hide the road ahead, I should be ready to understand the mistakes that others may make and be ready to pull off the road, if need be, to avoid an accident.

Mr. Van Wagoner—Mr. Hargreaves, I want to thank you especially for sharing with us these four steps leading to a new control in driving which eliminates accidents. Out of my own experience in driving I know that most of us are convicted on each one of these four steps. But I know there is something that I can do about it. This new attitude has to start in our own driving. I am going to do some checking up on my own driving with these four steps. I am going to ask each member of the State Highway Department to join with me in checking up his own driving. I will arrange to furnish each member of this audience a copy of these four steps if he, too, will do some checking up on his driving and perhaps share the results with me. You may obtain these copies by writing to the State Highway Department at Lansing. I agree with Mr. Hargreaves that safe using of the highways has to start with me and with you. The question is, what are we doing about it?

Thank you Mr. Van Wagoner and Mr. Hargreaves. Ladies and Gentlemen, you have just heard the tenth of a series of broadcasts over this station relating to the affairs of your State Highway Department. These broadcasts are brought to you by our State Highway Commissioner, the Honorable Murray D. Van Wagoner, and with him tonight on the program was Mr. R. C. Hargreaves of Detroit.

Triborough Bridge

By David Benjamin, M.E. '38

As early as twenty years ago, engineers foresaw that one day the traffic situation in the metropolitan area of the City of New York would require the construction of an almost fantastic system of bridges and roadways interconnecting the three boroughs—Manhattan, the Bronx, and Queens. At the time of its conception, a study of the problem was made by the Department of Plant and Structures. However no work was begun on the project until 1925. In this year a small appropriation was made for surveys, borings and plans.

A substantial increase in appropriations marked the beginning of active work on the project in 1926. Studies and plans were resumed, and the plan, essentially the same as that in present use, was adopted. Actual construction was begun in 1929. Anchorages and foundations for the towers were built, and the acquisition of much of the land needed for approaches and highways was completed. Operations had to be suspended in the early part of 1932 due to exhaustion of the funds.

TRIBOROUGH BRIDGE AUTHORITY

Because it appeared that the undertaking would be self liquidating after completion, the City of New York turned the project over to the Triborough Bridge Authority in April 1932. This agency applied at once to the Public Works Administration for sufficient funds to complete the work, which would otherwise remain unfinished.

The PWA made a loan and grant of $44,200,000 in September 1933, and work was resumed in December. With no subsequent interruptions the work has been on schedule since that time. The Authority was reorganized in 1934. Under a new engineering staff, the plans were revamped, resulting in a considerable saving of money by the elimination of an upper deck with eight lanes for traffic. The money thus saved was partly expended in the construction of the Manhattan East River Drive.

As in other PWA projects, the contracts for the bridge were awarded to private contractors through a system of competitive bidding. By law, the men were insured regular rates of pay.

The whole project may be broadly classified under two heads: (1) the bridges, viaducts and approaches, which include the crossings over the Harlem River, Little Hell Gate, the Bronx Kills, and Hell Gate; and (2) the highways and connections which lead to the bridges. These include fourteen miles of roadway in the three boroughs.

When the bridge is entered from the South, the Queens Approach is used. This is a viaduct, 1570 feet long, which connects the new depressed highway along Astoria Avenue with the suspension bridge.

THE BRIDGE ITSELF

The suspension bridge, which spans the Hell Gate, has its Eastern cable anchorage in Queens and its Western

one on Ward's Island. The length of the main span is 1380 feet, while the side spans from towers to anchorages are 704 feet, 8 inches long. The roadway is suspended from two parallel cables, 98 feet apart, each 20⅝ inches in diameter, and containing thirty-seven strands of 248 wires each. The cables were spun on the site of the bridge construction. Every wire is 0.196 inches in diameter and is galvanized to protect it against corrosion. Each cable contains 9176 wires. The maximum tension in the cables is 22,700,000 pounds. There is a sag of 138 feet, measured between the tops of the towers and the center of the span. The 98 foot spacing between the cables exceeds that in any other existing bridge suspended from two cables, and is exceeded only by the 106 foot cable spacing on the George Washington Bridge. The latter has four cables.

The towers of the bridge rise from concrete foundations, which are built on bed rock. From the top of the concrete piers to the base of the saddle castings carrying the cables, the towers rise 270 feet 8 inches into the air. Atop each tower is a thirty foot architectural lantern with airplane lights above it.

The floor of the bridge is an engineering masterpiece. It is built of massive girders, ninety-six feet long and eight feet four and one-half inches deep. On this floor is a roadway of two four-lane pavements, each forty-three and a half feet wide, and separated by a safety island.

From the West end of the suspension bridge a viaduct is carried across Ward's Island on concrete abuttments. Its 3000 foot length leads to the Little Hell Gate crossing. Little Hell Gate is not navigable, and the crossing cannot be opened. The roadway is carried 62 feet above mean high water, by six 125 foot girder stands. The length of this crossing is about 375 feet. After crossing Little Hell Gate, the viaduct procedes North over Randall's Island, to a three-level "flying junction."

The junction on Randall's Island serves a double purpose. At this location the Manhattan branch intersects at right angles the viaduct which connects the Bronx and Queens. The junction has two ramps encircling it, so that traffic can enter or leave the viaduct at Randall's Island, or can pass from a branch from any one of the boroughs to the viaduct leading to either of the other two, without a single grade crossing and with no left turns.

The junction also provides for the collection of tolls from the vehicles using the Triborough Bridge. The width of the roadway increases to 137 feet to provide for the toll booths. Tolls are taken from traffic going between Queens and the Bronx, at the point where the main viaducts leading to these two boroughs meet. Vehicles going to or from Manhattan pay tolls on the Manhattan arm of the junction.

Just North of the Randall's Island junction, another waterway must be crossed before the Bridge reaches the Bronx. This is the Bronx Kills—not navigable at present. The crossing is about 1000 feet long. It consists of a main span 350 feet in length, built of steel trusses, and two approach spans of similar construction. In case the Bronx Kills channel is made navigable in the future, the main span will be converted to a vertical lift, and is designed with this contingency in view. If this does come about, it will be larger than any existing vertical lift span in the world. The approach is a viaduct crossing over railroad yards just North of the bridge. This comes to ground level between 134th and 135th Streets, East of Cypress Avenue, where it runs into the Bronx connection.

From the flying junction, the Manhattan Branch extends West across Randall's Island as a long viaduct, leading to the largest existing lift span. The bridge, of which the lift span is a part, is 310 feet in length, and 93 feet in width. With its six traffic lanes and two sidewalks, it has a large traffic carrying capacity. The weight of the span is 2100 tons. The clearance in the normal position is 50 feet and when raised, the clearance is 135 feet—a lift of 80 feet. By counterbalancing the span with concrete counterweights in the towers, the unbalanced weight to be lifted by the bridge's four 200 horse power hoisting motors is only 65 tons

THE APPROACHES

The Manhattan approaches are West of the Harlem River lift span. The Manhattan bound traffic has a choice of two exits from the bridge. There is a three lane roadway continuing West to a plaza between First and Second Avenues. Another three lane roadway curves to the South and East, and connects with the new East River Drive. Vehicles entering the Bridge travel over similar approaches.

In Queens, a depressed highway is being constructed. At a number of points the road is bridged to allow surface traffic to pass in a North and South direction with no interruptions. At 70th Street the depressed roadways divide into the Astoria Boulevard Branch and the Grand Central Parkway Branch. The latter passes along Flushing Bay and joins the Grand Central Parkway at a huge intersection at Northern Boulevard.

The Bronx connections to the Bridge Plaza at 135th Street include more than six miles of highway. One connection leaves the plaza as a sixty foot roadway—an improvement of Whitlock Avenue. It is flanked by twenty foot sidewalks. Between Leggett Avenue, and Hunts Point Avenue, it widens to two forty foot pavements, separated by a landscaped island sixty feet wide. From Whitlock Avenue, the roadway continues along Eastern Boulevard as a sixty foot highway, with two twenty foot sidewalks.

When the New York World's Fair opens in the near future, the bridge will be a tremendous asset in the problem of handling the influx of traffic. Even now, through its traffic capacity, it is increasing the value of land in the vicinity and favors additional industrial expansion nearby.

LETTER NO. 2

27 Ash Street
Ezra, Indiana
April 3, 1936

Parke Davis Co.
Detroit, Michigan
Employment Manager

Dear Sir:

I trust that when you consider the anxiety of an ambitious young man to obtain some useful occupation and an honorable start in life, you will acquit him of any seeming indelicacy or obtrusiveness for encroaching upon your valuable time, in the capacity of an entire stranger.

Every man must make two important decisions in life. They are his choice of work and his choice of a wife. I am concerned with the former. My choice of work was chemical engineering, and in June I expect to graduate with a degree of B. S. in Chemical Engineering from Blank University, Ezra, Indiana.

I am a high school graduate and have, also, had two years of college work at Oak Grove University, Oak Grove, Ohio.

My age is twenty-one, I am American(of Scotch-Irish and English decent) and I am single. For the present salary is a secondary consideration.

My capibilities together with the desire to remain and grow with the business should grant me an interview. May I have this interview at your earliest convenience?

Yours truly,

Richard Roe

Richard Roe

Do You W
A Job

BY

HARVEY M. MEI

Superintendent of Manufa
Parke Davis Co., Detroit

JUST before graduation most senior
cerned with the question of emplo
important matter and it is only natu
be desirous of making a good impr
personal interview or letter of appli
deals only with the latter.

I have written a number of sugg
helpful in formulating a letter of ap
these suggestions are two examples: N
cellent impression, while No. 2 is the
will note that No. 1 is short, concis
giving all of the information that is n
2 uses flowery language and poor E
eral misspelled words, and on the who
favorable impression. These letters r
plications that have been received
story.

SUGGESTIONS FOR A LETTER

GENERAL SET-UP

1. State immediately that the letter is an application for employment.
2. If someone has suggested that you apply for a position with the organization, make that statement in the first paragraph.
3. Information regarding qualifications should be brief, but complete and comprehensive. Do not jumble facts—personal characteristics should be completely covered in one paragraph, education in another, experience in a third, references in still another, and miscellaneous information in another.
4. It is always well to mention an interview, unless the prospective employer is located too far away, in which case he will request the interview if he is especially interested in the application.
5. In seeking first positions it is just as well to leave all mention of salary out of the letter. All companies have their own salary scale, and this discussion can well be left until there
6. Pay particlular attention to the following
   (1) Be careful of the appearance of
   It is preferable to use only one
   A typewritten letter has an a
   longhand because it is usually
   This letter is a means of putt
   interview. You wouldn't app
   pressed suit, so why send a po
   (2) Errors in grammar and spelling
   Executives expect an engineer
   student.
   (3) Be sure to write the firm name c
   (4) Don't forget to sign your letter.

YOU WANT A JOB?

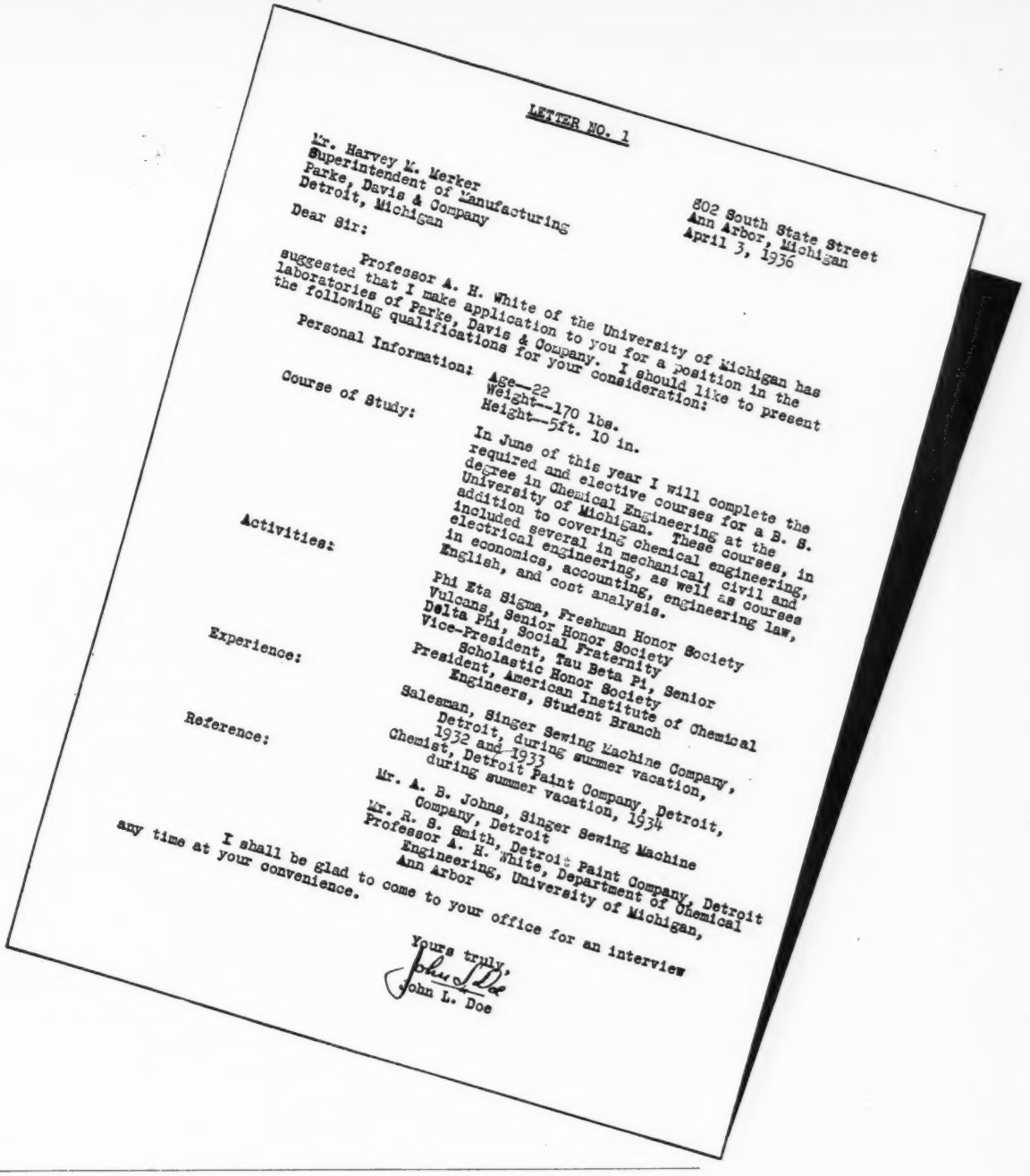
BY

RVEY M. MERKER

intendent of Manufacturing,
e Davis Co., Detroit, Mich.

duation most seniors are primarily con-
e question of employment. This is an
and it is only natural that one should
aking a good impression, whether by
or letter of application. This paper
e latter.

a number of suggestions that may be
ating a letter of application. Following
are two examples: No. 1 creates an ex-
while No. 2 is the exact opposite. You
o. 1 is short, concise and to the point,
nformation that is necessary. Letter No.
nguage and poor English, contains sev-
rds, and on the whole leaves a most un-
on. These letters represent actual ap-
ve been received and tell their own



LETTER NO. 1

Mr. Harvey M. Merker
Superintendent of Manufacturing
Parke, Davis & Company
Detroit, Michigan

802 South State Street
Ann Arbor, Michigan
April 3, 1936

Dear Sir:

Professor A. H. White of the University of Michigan has suggested that I make application to you for a position in the laboratories of Parke, Davis & Company. I should like to present the following qualifications for your consideration:

Personal Information: Age—22
Weight—170 lbs.
Height—5ft. 10 in.

Course of Study: In June of this year I will complete the required and elective courses for a B. S. degree in Chemical Engineering at the University of Michigan. These courses, in addition to covering chemical engineering, included several in mechanical engineering, electrical engineering, as well as courses in economics, accounting, engineering law, English, and cost analysis.

Activities: Phi Eta Sigma, Freshman Honor Society
Vulcans, Senior Honor Society
Delta Phi, Social Fraternity
Vice-President, Tau Beta Pi, Senior Scholastic Honor Society
President, American Institute of Chemical Engineers, Student Branch

Experience: Salesman, Singer Sewing Machine Company, Detroit, during summer vacation, 1932 and 1933
Chemist, Detroit Paint Company, Detroit, during summer vacation, 1934

Reference: Mr. A. B. Johns, Singer Sewing Machine Company, Detroit
Mr. R. S. Smith, Detroit Paint Company, Detroit
Professor A. H. White, Department of Chemical Engineering, University of Michigan, Ann Arbor

I shall be glad to come to your office for an interview any time at your convenience.

Yours truly,
John L. Doe
John L. Doe

OR A LETTER OF APPLICATION

be left until there is an actual position in view.
on to the following points:
the appearance of your letter.
le to use only one sheet of paper.
n letter has an advantage over one written in
ecause it is usually neater and easier to read.
s a means of putting yourself across before the
You would n't appear in a dirty shirt and an un-
, so why send a poor looking letter?
mmar and spelling are black marks against you.
expect an engineer to be as correct as an English

ite the firm name correctly.
to sign your letter. This may seem like unneces-
sary advice, but in ONE WEEK last year we received three unsigned letters of application. If your handwriting is not legible, it is a good idea to type your name below the signature, but never send out a letter with only a typed signature.

TONE

1. Write in a tone that will give the impression of self-confidence, without being "cocky."
2. Be courteous, but do not try to court favor through flowery phrases.
3. Do not apologize for taking up the time of the prospective employer. You have something to sell, and if the letter is well-written and convincing, the employer will be glad to have the application on file, even if there is not a position open at the moment.

Reprint from November, 1936 *Michigan Technic*

EDITORIALS

THE AGE OF ENGINEERING

The new year begins and with it continues an ever-accelerating program of engineering expansion. The most direct and evident indication of activity in the engineering field is the increasing employment rate. More and more engineers are being employed, not only in strictly engineering jobs, but also in managerial posts and executive positions of all descriptions. Employers are beginning to realize that the engineer's education makes him valuable not only as a technician and designer, but also as a thinker and organizer.

The fields in which the engineer may apply his knowledge have become more extensive with passing time, until at present he is practically unlimited with regard to his choice of a field of specialization. Methods once applicable to industrial processes alone, have been extended until they are making themselves felt in every branch of commerce. Thus the engineer will, in all probability, as time goes on, find himself more in demand by those businesses which wish to lower costs with an engineering approach to their problems, either with new methods of manufacture or with new methods of cost-accounting.

The need to lower cost is being brought home more strongly every day in all types of commercial enterprises. Due to the success in manufacturing of time-cost and time-motion analyses, these studies are being extended to cover distribution and marketing, and it is quite probable that eventually an entire business from the collection of raw material to the retailing of the finished product will be as scientifically planned as each manufacturing process is at the present time. The surface has only been scratched with relation to time-motion studies and it is probable that in the future one of the engineer's major problems will be the application of cost systems to branches of work not strictly in the engineering profession.

Besides the new field of costs in marketing, distribution and retailing, the engineer will find other new applications of his knowledge in branches of industry which are being greatly enlarged as the result of either new inventions or new methods.

Communications engineering is being developed enormously. The coming of television will present entirely new problems both in design and practice. It is impossible to predict at the present exactly what effect television will have upon the economic situation as far as the engineer is concerned, but in all probability its effect will be very marked.

Diesel engines and electrical machines are being developed which have made these forms of power even more efficient and economical than ever before. The application of the diesel to railroading and the consequent design changes for high-speed operation of the entire train have virtually created a new industry. The success of the streamlined train is history, but the further development of the industry is yet to come. The quite evident instillation of new life in the railroads as the result of the speed and styling of the new trains has been beyond even the expectations of the most optimistic of professional optimists. It has given the railroads new food for thought and it would seem that there will be, in the very near future, a decided change in railroad policies, in regard to passenger rates and traffic, and, eventually, freight traffic will be effected. This may very well mean new and important openings for engineers.

The above are only examples of the subjects with which the engineer will become involved in the future. Application of engineering to farming is becoming much closer to a reality. Utilization and conversion of farm products for industry is already an accomplished fact. The introduction of the sodium vapor lamp and improvements in the mercury vapor lamp open a new field in the study of illumination for the electrical engineer. Drainage control and the prevention of soil erosion and dispersion are subjects upon which study is only beginning. Traffic control, electrification of railroads, coördination of government activities, rate studies for utilities and government, electronic control of power—all of these are new and relatively unexplored fields for the engineer. The list could be extended indefinitely. It will suffice to say that opportunities of almost unlimited scope will be presented to the engineer in the next few years. It is indeed the Age of Engineering.

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ON ASKING QUESTIONS

It is an old saying that the squeaking wheel gets the oil. Are you a squeaking wheel? That is, do you ask questions, or are you afraid of exposing your ignorance?

It is unfortunately true that many of us hesitate to ask a question. Particularly are we hestitant in asking them of persons whom we should ask the most—our instructors. We often feel that our questions will appear to show up the fact that we haven't prepared an assignment suffiiciently well. Is it not better to question those above us, who have obtained part of what they know through asking questions? It is a means of study. If you are doubtful, ask your instructor.

Do You Know These Men?

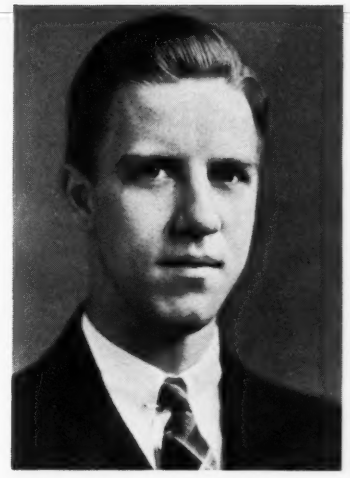
JOHN TITUS BARTON

Establishing a unification of the upper and lower classes in the various colleges at Cornell is the object of work which John Titus Barton, '37 CE, '39 ME, has been doing through the medium of the C.E. society Chi Epsilon. John feels that acquainting the upperclassmen with the underclassmen, especially the freshmen, in their college would result in a friendlier, more congenial atmosphere on the campus as well as greater individual accomplishment in scholastic and extra-curricular work.

A graduate of the Cook Academy class of 1933, John is a resident of Montour Falls, New York. He entered Cornell in 1934 with the idea of following a family tradition in civil engineering. Above the rest of his extra-curricular achievements he places his appointment as laboratory assistant in the Engineering Geology Department. He is also Secretary-Treasurer of Chi Epsilon, Vice-President of the A.S.C.E., Vice-President of Pyramid, and a member of Tau Beta Pi. Beside participating in these activities John has found time to sing in the Glee Club, take a part in the opera "Pinafore," and row with the C.E. Crew.

Summers Barton has spent doing practical work in connection with his civil engineering course; first as a chainman on a surveying gang, later using a transit on road construction work, and more recently reconstructing bridges which were washed out in last summer's floods. His strongest inclinations are, however, toward mechanical engineering. His interest in this field began at an early age when he burned up the roads around his home in a vehicle constructed of an outboard motor, a stair-tread, bicycle sprockets, express wagon wheels, and an oil can cooling system.

After graduation John hopes to do development work in the automotive field. Taking most of his available options in metallurgy, he sees a great possibility of improvement in the present-day motor car through the development of new steels and other alloys which go into its make-up.



JAMES RICHARD WARE

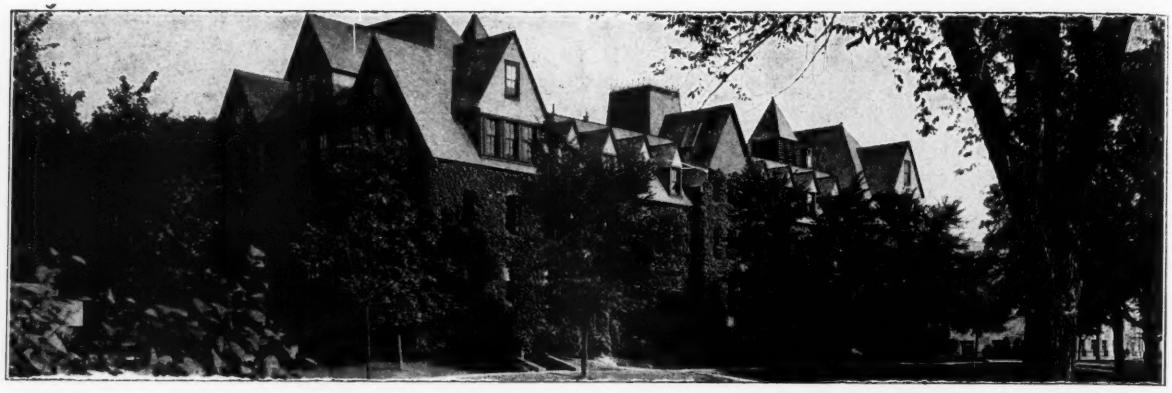
With a summer spent in practical work in the research laboratories of the General Motors Corporation, supplemented by outstanding scholastic and extra-curricular work at Cornell, James Richard Ware is preparing for what should be a highly successful career in the engineering field.

Jim prepared at Montclair High School in Montclair, New Jersey, his home town. Here he was Vice-President of his Junior Class and Chairman of the school Elections Committee. After matriculation at Cornell he was awarded an Ezra Cornell two year scholarship.

While here at school Jim has particularly valued the opportunity for social contacts and work on committees. His sophomore year he won second place in the track competition. Following this he won the Sibley Prize in his Junior year and was elected to Red Key. Now a member of Tau Beta Pi, Phi Kappa Phi, Quill and Dagger, and the A.S.M.E., Jim also finds time to fill the position of President of Atmos. Beside being President of his own fraternity, Delta Phi, he has served on the Red Key Dance Committee, and is currently working on the Junior Week Carnival Committee.

Last summer Jim spent at the General Motors plant with several other college students doing test work on various types of engines. His contacts in this work have gained for him some very valuable experience, as well as a desire to concentrate on the problems of diesel engine design, which work he hopes to follow up after college.

Miniature photography and sailing occupy what time Jim is able to devote to hobbies. The story is told of how he and some friends went to Princeton for a week-end. When Jim admitted to being somewhat of a sailor, a race was proposed. Borrowing a boat from a student, he and his friends won two of the three races against the Princetonians in their own boat, and on their own Lake Carnegie. In his own boat, on Cayuga, Jim would present a rather formidable picture to any outsider interested in sailboat racing against Cornellians.



COLLEGE

WELDING TECHNIQUE

At a joint meeting of the Ithaca Section and the Student Branch of the American Institute of Electrical Engineers held on January 8, Mr. W. C. Hutchins of the General Electric Company discussed Modern Welding Technique and Equipment. The meeting was well attended by students, faculty from the various engineering schools, and numerous out-of-town engineers. The welding laboratory at G-E has, according to Mr. Hutchins, solved some of the more perplexing problems connected with welding. He emphasized the fact that probably the most important characteristics of a.c. welding over which control must be exercised were those of wave form and time of current duration. The problem of complete control of these elements has been solved in a satisfactory manner by the use of a combination mechanical-pneumatic welder with thyratron and ignitron control.

Good control of the time and wave-form of the a.c. weld reduces faulty welding to a minimum, prevents oxidation of the surface of the material, makes for faster welding time, and broadens the entire field of welding. By means of the control apparatus designed in the laboratory, control of welding time has been gained to the point where it is possible to have a weld completed in anywhere from one-half cycle to forty cycles with intervals of the same amount for spot welding. This accurate control has made possible the lowering of rejections in one G-E manufacturing process to one-half of one percent.

Mr. Hutchins also discussed the welding of chrome-nickel steel, increased speed in making of spot-welds and seam welding, the importance of proper voltage supply and current carrying cable, and the welding of dissimilar metals. By regulating the pressure, current and time of weld, experts were finally able to weld together aluminum and copper in welds which were stronger than the aluminum. Upon completion of the lecture, samples of the various types of welding were demonstrated.

HEAT POWER TRIP

About sixty-five students of the Mechanical and Electrical Engineering schools, went to New York under the direction of Professor F. O. Ellenwood for the Heat Power trip. Starting in the offices of the Brooklyn Edison Company, the group spent the morning inspecting the company's Hudson Street Plant. Returning to the offices at noon, they had lunch with a group of Cornell men who work for the company. That afternoon the group inspected the building and visited the research laboratories. In the evening most of the men visited the Power Show then being held at the Grand Central Palace.

The next morning the party was divided into two groups, one of which inspected the Queen Mary, while the other inspected the air-conditioning equipment of Radio City.

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ATMOS-KAPPA TAU CHI BANQUET

A joint initiation banquet by the Atmos and Kappa Tau Chi honorary societies was held in Willard-Straight Hall Terrace Room on December 11. The initiation of new members preceded the banquet and along with an address by Mr. Howard L. Davis, personnel and employment director of Western Union-Bell Telephone Co., constituted the bulk of the evening's program. Dean emeritus Kimball and Dean Herman Diederichs of the College of Engineering were present at the banquet.

Mr. Davis's speech was entitled "Preparing Yourself for Getting a Job." It was followed by a period devoted to open forum to enable the audience to question the speaker.

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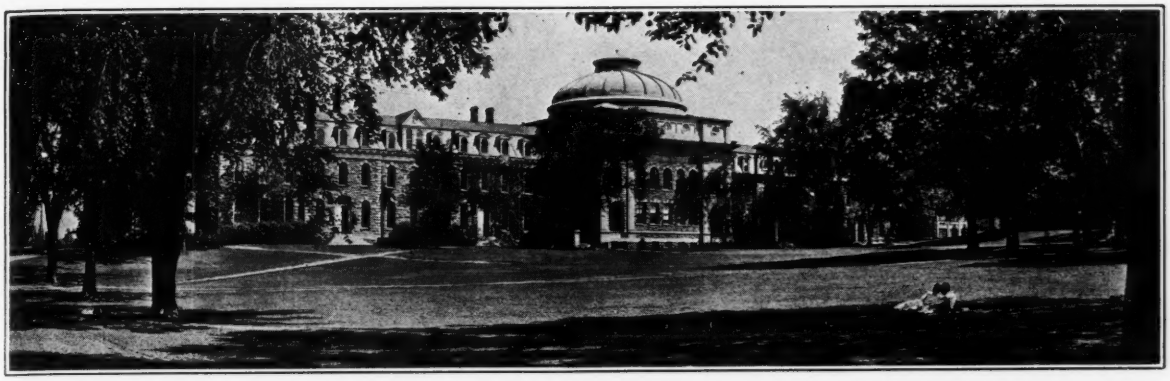
WOMEN IN SIBLEY

Sibley Hall, the heart of the Engineering College, has long been the happy retreat of student engineers. Here we could be carefree, here we could be ourselves



NOTES

and act as we wished, for this hall for engineers, and engineers alone, has seldom felt the tread of co-ed feet. Far from the restraint of the designing female we were free and happy. But alas, the end has come, this privacy is gone, our sanctum sanctorum has been invaded. A course in Industrial Organization, open to co-eds in the College of Architecture (and there are a few), meets within the confines of West Sibley. Something must be done! If this infringement on our right to privacy is permitted to continue the engineer may some day become a stranger within the very walls of his own college. Think of the future! Arise, fellow engineers, rebell!

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THE MECHANISM OF HEARING

Dr. Frederick Bedell of the Physics Department, in a lecture before the Cornell members of the American Institute of Electrical Engineers, on "The Mechanism of Hearing" gave his definition of hearing as a "refined sense of touch."

All animals are able to detect sound vibrations in some manner, Dr. Bedell pointed out, but the mechanisms by which they accomplish this vary widely in construction and location with the different species. Crickets and katydids, for example, have ear drums on their thighs, while snakes are able to detect vibrations rising from the ground through their bellies.

Dr. Bedell described briefly the nature of sound waves. He then proceeded to explain the process by which they are received by the ear, changed to nerve impulses, and transmitted to the brain. A comparison of the mechanisms of hearing in man and animals was illustrated with slides which Dr. Bedell had prepared himself.

As an interesting analogy he likened the brain cell to battery sub-stations with interconnecting local and long distance lines. An electrical train of waves was pictured as surging back and forth, their rhythm being disturbed only by sound and the sensation of emotion.

A practical benefit which physicists have made to medicine as a result of their recent intensive study of this subject is that, with the knowledge gained in this field, it is now possible to predict an epileptic seizure eighteen or more hours in advance.

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BOOKS PRESENTED TO COLLEGE

The College of Engineering has just received a number of textbooks that were the property of Mr. Ralph C. Many who died in an untimely way on October 8th. 1935. The books were sent by his father, John L. Many of New Orleans, La., with the request that they be used in any way that would help other students in the College.

Mr. Many was a brilliant student and it is tragic indeed to have a promising career closed so suddenly.

The CORNELL ENGINEER is proud to announce the election of the following men to the staff:

Business Board:

Julian Kheel, '39 C.E.
Albert T. Mayle, Jr., '39, E.E.
Thomas L. Snowdon, '39, E.E.

Editorial Board:

David Benjamin, '38, M.E.
Aaron H. Sullivan, '38, E.E.
Douglas B. Blackburn, '39, M.E.

CORNELL SOCIETY *of* ENGINEERS

J. D. TULLER '09, PRESIDENT

WALKER L. CISLER '22, VICE PRESIDENT — ADAM C. DAVIES, JR. '15, VICE PRESIDENT

DAVID HARMON '31 RECORDING SECRETARY — JOHN P. SYME '26, SECRETARY AND TREASURER

"The objects of this Society are to promote the Welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Column

January 4, 1937

Fellow Engineers:

At the organization meeting of the executive committee of the Cornell Society of Engineers, held in New York on November 4, the following alumni were elected to the executive committee as members at large: Mr. C. R. Vanneman, '03, and T. S. Chadeayne, '29, representing the College of Civil Engineering. H. B. Reynolds, '13, and R. B. Shreve, '27, representing the Mechanical Engineers, and S. S. Williams and W. H. Carrier, '01, representing the Electrical Engineers.

A meeting of the full executive committee is to be held during the second week of January, at which time plans are to be made for the next general meeting of the Society. This will probably be held the latter part of January or early in February, in New York City.

Among Alumni activities none would seem to be of more value to the individual than that of the Cornell Placement Offices. Mr. Paul Reyneau, M.E. '13, is director of the Cornell Club Employment Service, in New York City. He has sent for inclusion in this column the following statement:

"The prediction that a shortage of engineers was imminent, made many times during the last two years, seems to be coming true. There already appears to be a great demand for men trained in certain specific engineering fields, and such men are very difficult to find. Employers, having been able to obtain the exact type of training they needed in the last few years, have not yet generally been willing to accept men who would require some training before they could carry out their specific duties in the best possible manner. As engineers get scarcer there will undoubtedly be less specific requirements to be met by applicants.

"Many of the large companies are finding that they have too few engineers in their training courses and are diligently trying to find satisfactory prospects. This means that the demand for engineers from the last two or three classes, particularly in mechanical and electrical engineering, has been great and that most men have been able to secure satisfactory connections. Great improvement also has been evident in the field of civil engineering, where many of the younger men have been able to secure good jobs in their chosen fields.

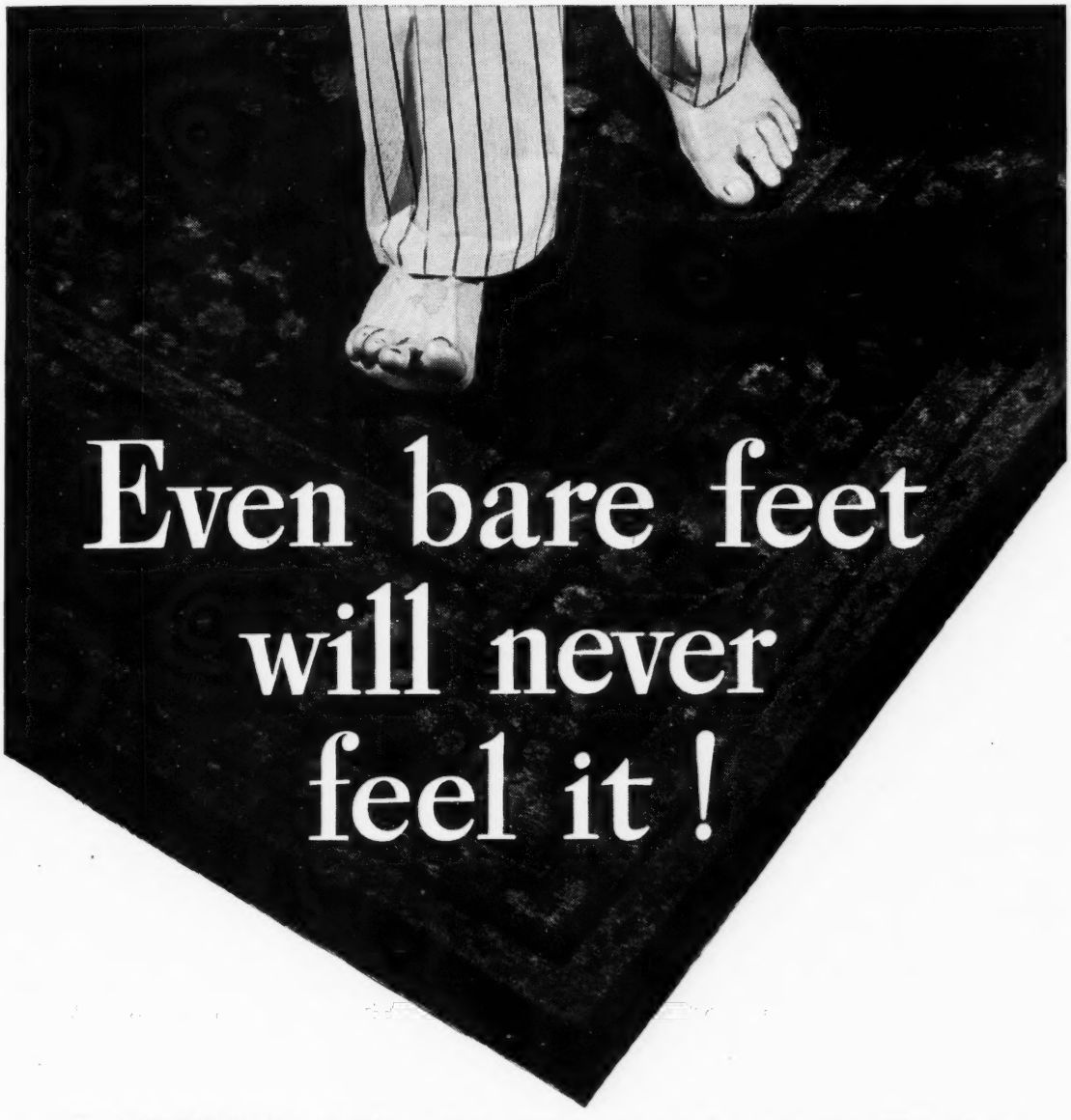
"While the outlook for young engineers has greatly improved, it can be said fairly that the outlook for older men also is more favorable. There seems to be a fair number of good jobs for engineers who have been out of college for five to fifteen years. Good openings for mature men are appearing now once in a while, which was not true six months ago. It seems evident that as business increases the demand for trained executives will be felt and that with the continuance of increased business activity the outlook for all trained men should be favorable.

"It is obvious that engineers as a class have suffered greatly from the depression and that time and effort will be required to get most of them satisfactorily employed. However, it seems that the present time is an excellent one, if business continues to improve, for all those engineers who have been forced to abandon their chosen careers actively to plan a campaign to secure the work they want to do.

"The Cornell Club Employment Service in New York City under the direction of Paul O. Reyneau, '13, and the University Placement Bureau in Ithaca under the direction of Herbert H. Williams, '25, are ready to assist all Cornell engineers who want to take advantage of their facilities, be they employers or men looking for work or changes of association. The office in the Cornell Club, at 245 Madison Avenue, confines its work to the New York Metropolitan District. All correspondence and all inquiries outside this district should go to the Ithaca office. The two offices cooperate in exchanging openings and applicants."

All of us are indebted to those who have gone before us, for what they have done to make our road smoother

(*Continued on page ninety-four*)



Even bare feet will never feel it !

OCCASIONALLY a telephone wire must be run under a rug or carpet. The twisted wire formerly used made an unsightly ridge.

So Western Electric—manufacturing, distributing and purchasing unit of the Bell System—produces a flat cord only one-eighth inch thick, seven-eighths of an inch wide. (Like this). Within this tiny space are four conductors of insulated wire. Under the rug or carpet this cord is not seen, not even felt with bare feet.

Even to the smallest detail, the Bell System is constantly on the lookout for the better way to make telephone service more satisfactory to the customer.

College men and women find after 7 P. M. a convenient time for long distance calling. Moreover, most rates are lowest then.

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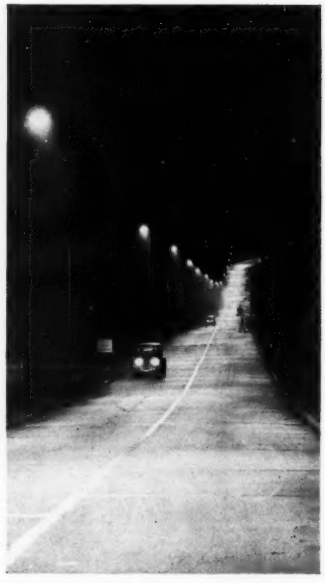
INCANDESCENT NOT SODIUM VAPOR

The December issue of the ENGINEER carried the two pictures which are reproduced here to illustrate an article on sodium vapor lighting for highways. This was an error on our part, for actually these are not sodium vapor lights but incandescent lamps used in a safety-lighting demonstration on a one-mile stretch of U. S. Route 422 near Cleveland, Ohio. The demonstration embodies the results of researches conducted on the General Electric Company's Model Highway at Nela Park, Cleveland. The lighting equipment consists of forty experimental reflectors of a basically new design, fabricated from Alzak alumninum, equipped with 4000 lumen incandescent lamps and mounted 25 feet high, 125 feet apart, and extending five feet out over the pavement.



Three outstanding features of this system which account for the great gain in visibility and safety are:

1) The proportion of light reaching the pavement and shoulders is more than doubled as compared with former equipments.

2) Glare is suppressed by completely shielding the light sources to approximately 10 degrees below the horizontal, largely obviating the interference with seeing, which in former systems has wasted as much as one-half of the illumination.

3) The road surface presents an altogether higher order of uniformity of brightness, free from areas of low visibility.

In short, with this system the driver sees quickly and surely, headlights are much less glaring, night driving becomes a comfort, and walking on the highways becomes much safer.

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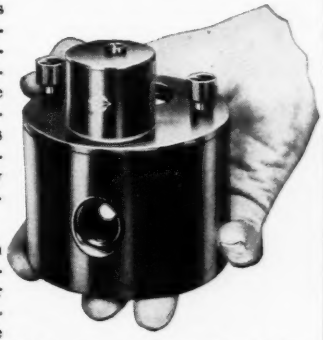

• This galvanometer is an inexpensive instrument with the sensitivity of a reflecting galvanometer and the ruggedness of a milliammeter. It requires no levelling or clamping and is accordingly well adapted for general laboratory use.

It is fitted with both a pointer and a reflecting mirror suitable for "null" point indications as well as for use with a lamp and scale. It is only one of many Cambridge Galvanometers.

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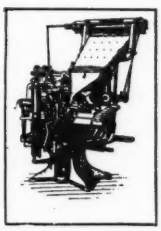

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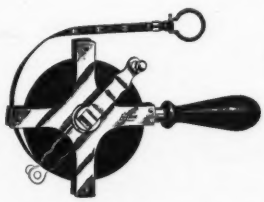

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President's Column

(*Continued from page ninety*)

and easier. In this connection it is perhaps appropriate here to give recognition to the voluntary and unselfish work done by those Cornell engineers who started and carried on the work of placement for Cornell engineers. The first one that we know of was Clyde Potts, '01. He started about 1908, representing the Cornell Society of Civil Engineers, and confined his efforts to helping civil engineers. Later when the three colleges were joined under one head about 1920, C. S. Rindsfoos, '06, representing the Cornell engineers, undertook placement work for all Cornell engineers. Mr. C. R. Harding, '10, took up this work about 1922 and carried on about two years. He was followed by C. M. Chuckrow, '11, who carried on until 1928; H. E. Irish, '16, succeeded Mr. Chuckrow and continued until the establishment of the Cornell Club Employment Service in 1932.

The Cornell Club Employment Service came into being as the result of the efforts of Jansen Noyes, '10, who was at that time President of the Cornell Club in New York. Soon after the establishment of the Cornell Club Employment Service, the University itself established a placement bureau in Ithaca to handle placement work for all Cornellians. This was undertaken as a result of the success of the Engineers prior to the establishing of the Cornell Club Employment Office. The Alumni owe a debt of gratitude to Messrs. Potts, Rindsfoos, Harding, Chuckrow, and Irish for the generous work done by them in the early days of Cornell Placement work.

In conclusion the writer urges Cornell men to use the services of the two Employment offices, whether the object be the securing of additional personnel or securing employment. If you are an employer try to fill your requirements from Cornell Alumni. You will find excellent material among the recent graduates if your experience corresponds to that of this writer, and those he has talked with. As for the older men, most employers of engineers know the position that is generally accorded Cornell engineers. It is seldom indeed that one hears anything but favorable comment in this connection.

Sincerely your,
J. D. TULLER,
President

—o—

'11 CE—A. Manuel Fox, director of research of the United States Tariff Commission, gave an address at Princeton University April 18 on "The Reciprocal Trade Agreements Program." He attended the Princeton-Harvard-Yale conference on Government and Economic Stability at Princeton May 8 and 9. His address is % United States Tariff Commission, Washington, D. C.

'11 CE—Nathan R. Finkelstein writes to the New York Times, March 25, protesting the new corporation tax schedule.

Alumni Notes

'11 AB, '13 ME—Ralph E. Pierce is an engineer for the American Telephone and Telegraph Company, 195 Broadway, New York City. On April 23 he spoke to the Signal Corps Reserve Officers organization of the Washington, D. C., area on "A Nation-wide Teletypewriter Exchange System."

'11 ME—Hugh M. Platt married Mary C. Walsh, of New York City, last June. They have moved to Batavia, where he is Secretary and Treasurer of the Batavia Times Publishing Company. His address is 401 East Main Street.

'20, '21 ME—A son, Douglas Ellis, was born April 17 to William D. Ellis, III, and Mrs. Ellis, 14 Chatham Road, Atlanta, Ga. Ellis is President of Southern Mills, Inc., 585 Wells Street, S. W., Atlanta.

'21 AB; '15 ME; '15 MA—The husband of the former Helen Stankiewicz '21, Stephen J. Zand, is research engineer and acoustical expert for the Sperry Gyroscope Company in which Edward G. Sperry '15 and Elmer A. Sperry, Jr., '15 are officials. Zand has just returned from six-months in Europe, where he applied American sound-proofing methods to eight types of commercial airplanes for Air France.

'29 ME—Robert M. Smith married Catharine T. Deyo of Poughkeepsie on April 25. Mrs. Smith is a graduate of Vassar and Katherine Gibbs School. Smith is employed by the Rutherford Press in New York City. They will live at 291 Montross Avenue, Rutherford, New Jersey.

'31 CE—Edwin A. Courtney was married on May 16 to Miss Esnie Eleanor Patterson, daughter of Mr. and Mrs. A. Balfour Patterson of Houston, Texas.

'32 CE—Richard O. Furlow was married to Miss Eleanor Long of Superior, Nebraska, on June 7, 1936.

'34 CE—Harold C. Wafler married Geraldine M. Bell, in Ithaca, April 4. Mrs. Wafler is a graduate of Syracuse General Hospital in 1934. Wafler is an engineer with the Resettlement Administration. They live at 511 East Buffalo Street, Ithaca.

'35 ME—Jean F. Mitchell is a sales engineer with Ingersoll-Rand, 11 Broadway, New York City, in the Cameron pump division. He lives with Hugh Mason, '35, who works for the same company in the condenser department.

'35 A. E.—H. De La Toue Bueno is an apprentice engineer with the Pan American Airways. His address is 706 S. E. Elizabeth St., Brownville, Texas.

'35 A.E.—G. P. Torrence, Jr., is serving an apprenticeship at the Link Belt Co., of Chicago. He may be reached at 1315 Davis St., Evanston, Ill.

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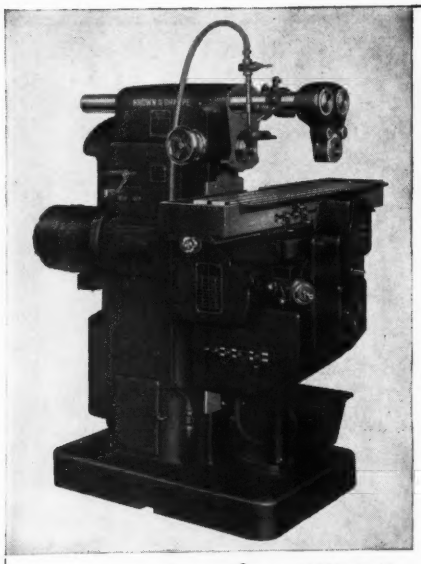

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Stress & Strain

He: "Guess that my pen will have to go on itching."
She: "Why?"
He: "I'm out of scratch paper."

* * *

Sign on an art student's door: "If I am studying when you enter, wake me up. "

* * *

Professor: "Do the quick thinkers become leaders?"
Freshman: "Well, he who hesitates is bossed.

* * *

Professor: "'You missed my class yesterday didn't you?"
Senior: "Not in the least sir, not in the least."

* * *

"Multiply 2z by e."
"Aw, that's too easy."

* * *

Upon being told that a man was tempted to kiss her every time he looked at her, the young thing indignantly said, "Now, look here, young fellow."

* * *

Tongue twister: A skunk sat on a stump. The skunk thunk the stump stunk and the stump thunk the skunk stunk.

* * *

Davenport Chess—She moves into his arms and then neither moves for several hours.

* * *

Living in Ithaca, it is hard to refrain from telling the one on the poor farmer who always had trouble in the winter with the radiator of his car freezing up. Finally, after observing the properties of Cayuga lake water for about twenty winters, he solved the problem by putting some of it in the radiator. Can you imagine his surprise during the next cold snap?

* * *

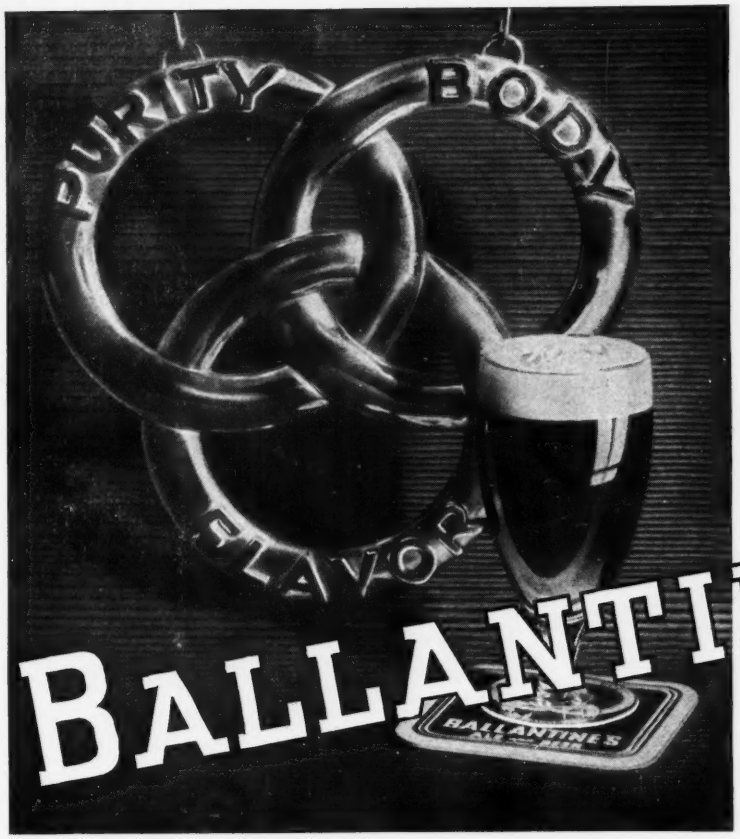
Sign in a boiler room: "Have faith in the Lord, but keep a full glass of water."

* * *

A man looking at some neckties tossed one or two aside rather contemptuously. Lingering after having made his purchase, he noticed that the clerk put those he had so positively rejected into a separate box.

"What becomes of them," he inquired?

"We save them for the women who come in here to buy ties for men," was the reply.



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Ethyl Gasoline Corporation, Chrysler Building, N. Y. C.

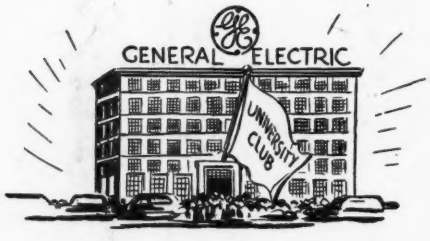
G-E *Campus News*

LIGHTNING STRIKES TWICE

LIGHTNING may strike not only twice but a dozen times in the same place over the same path within one second's time. This is one of the unusual facts that Karl B. McEachron, Research Engineer of General Electric's High-voltage Laboratory, has found out about lightning.

Even more unusual is the new theory that the brilliant lightning flash one observes during a storm is not a bolt from the sky, but a union of a cloud streamer with a similar one from the earth. The action of the air currents and of the falling drops of water separates the charges in the cloud. When the voltage in the cloud reaches a certain value, a streamer starts toward the earth, traveling in jumps at about one-tenth the speed of light. When this streamer is a few hundred feet away, streamers from four to eight feet long begin to form on the surface of the earth. When the streamer from the clouds unites with one from the earth, the flash of lightning occurs. The pressure generated during the passage of current makes the thunder.

General Electric conducts research in lightning so that its engineers can design transmission lines and protective equipment which will insure better continuity of service.



UNIVERSITY CLUB

DAVE PACKARD of Stanford and Otto Schwartz of Columbia played against each other in the Rose Bowl game of 1934, but now they are working side by side in the Schenectady Works of the General Electric Company. This seems unusual until it is pointed out that in the General Electric organization is one of the largest and most cosmopolitan university clubs in the world. Approximately 4500 college graduates, representing 237 American universities, colleges, and technical schools, are employed by the Company. In addition, there are 198 graduates from universities in 22 foreign countries.

Ten educational institutions have contributed more than 100 graduates each to the General Electric family. They are: Cornell, Iowa State, M.I.T., Penn. State, Pratt Institute, Purdue, Union College, U. of Colorado, U. of Michigan, and Yale. Fifteen other schools have provided more than 50 graduates each. They are: Case School, Georgia Tech., Kansas State, U. of Maine, U. of Minnesota, Ohio State, R.P.I., Syracuse, U. of California, U. of Illinois, U. of Kansas, U. of Nebraska, U. of Wisconsin, V.P.I., and Worcester Polytechnic.

DETECTING LIES

PAPA WASHINGTON needed no lie detector; George told the truth. But as a check on less truthful persons, Northwestern University's crime-detection laboratory has developed a lie detector. It makes simultaneous measurements of respiration, blood pressure, and perspiration. Emotional disturbances are reflected in these body functions. And since extremely sensitive recording instruments are needed to record changes in perspiration, the delicate photoelectric recorder developed by General Electric engineers is put to work.

For many years General Electric has made instruments for exacting applications. This same photoelectric recorder is used to obtain a continuous record of temperature in a wire-enameling oven. Electric gauging of ball-bearing diameters, of wire diameters, and of strip thickness is accomplished in rolling mills. These operations and hundreds of others are recorded by this instrument, and with a power consumption of only one thousandth of a microwatt.

96-348DH

GENERAL ELECTRIC